

**THERMAL ENGINEERING-I
(MECHANICAL ENGINEERING)****Time: 3 Hours****Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	What is an internal combustion engine? What are the basic components of an IC engine?	7M	1	L2
	b)	Describe with neat sketches the working principle of 4-stroke SI engine.	7M	1	L2
(OR)					
2.	a)	Draw and explain the valve timing diagram for a 4-stroke petrol engine.	7M	1	L2
	b)	What are the advantages and disadvantages of 2-stroke engines? Why are 2-stroke engines rarely used in modern vehicles?	7M	1	L2
		<u>UNIT-II</u>			
3.	a)	Define fuels and classify their various types. Explain flash point and fire point.	7M	2	L2
	b)	How are SI and CI engine fuels rated? Explain its importance.	7M	2	L2
(OR)					
4.		An eight-cylinder, four-stroke engine of 9 cm bore and 8 cm stroke with a compression ratio of 7 is tested at 4500 rpm on a dynamometer which has 54 cm arm. During a 10 minutes test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4 kg of gasoline having a calorific value of 44000 kJ/kg. Air 27°C and 1 bar was supplied to the carburettor at the rate of 6 kg/min. Find (i) the brake power delivered (ii) the brake mean effective pressure (iii) the brake specific fuel consumption (iv) the brake specific air consumption (v) the brake thermal efficiency (vi) the volumetric efficiency and (vii) the air-fuel ratio.	14M	2	L4
		<u>UNIT-III</u>			
5.	a)	Explain the effect of variables responsible for knocking in SI engines.	7M	3	L2
	b)	Briefly explain the flame front propagation. Explain the various factors that influence the flame speed.	7M	3	L3
(OR)					
6.	a)	Describe in detail the stages of combustion in an CI engine?	7M	3	L2
	b)	Explain diesel knock and factors which reduce knocking.	7M	3	L2
		<u>UNIT-IV</u>			
7.	a)	Describe the basic working principle of an EFI system?	7M	4	L3
	b)	Distinguish between D-MPFI and L-MPFI systems?	7M	4	L3
(OR)					
8.	a)	Why is cooling necessary in internal combustion engines? What are the two main types of liquid cooling systems?	7M	4	L2
	b)	How are engines classified based on the method of cooling? Compare air-cooled and water-cooled engines.	7M	4	L2
		<u>UNIT-V</u>			
9.	a)	What are the advantages and disadvantages of BEVs compared to PHEVs?	7M	5	L2
	b)	What are the key differences between lithium-ion and lead-acid batteries used in EVs?	7M	5	L2
(OR)					
10.	a)	What is the primary function of a Battery Management System in an electric vehicle? How does the BMS help in prolonging battery life?	7M	5	L2
	b)	What are common methods used for battery thermal management? How can overheating affect battery performance and safety?	7M	5	L2

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Five channels, each with a 100-kHz bandwidth, will be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference?
- b) Differentiate between Guided and Unguided Media. Give an example.

Marks	CO	BTL
7	CO1	L2

(OR)

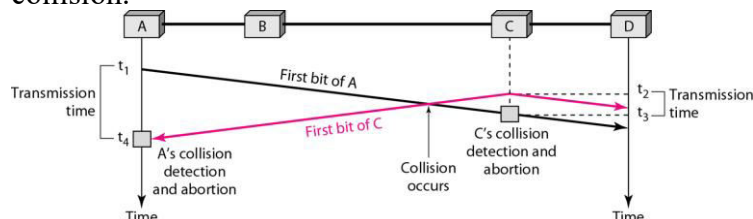
2. a) Explain the different network topologies with diagrams. Discuss the advantages and disadvantages of each topology.
- b) Describe TDM multiplexing technique with suitable examples. How do this method improve channel efficiency?

7	CO1	L2
7	CO1	L2

UNIT-II

3. a) In the below figure, the data rate is 10 Mbps, the distance between station A and C is 2500 m, and the propagation speed is 2×10^8 m/s. Station A starts sending a long frame at time $t_1=0$; Station C starts sending a long frame at time $t_2=3$ microseconds. The size of the frame is long enough to guarantee the detection of collision by both stations. Find:
- i) The time when station C hears the collision (t_3).
- ii) The number of bits station C has sent before detecting the collision.

7	CO2	L4
---	-----	----



- b) Explain the major design issues of the Data Link Layer. How do these issues influence reliable communication?

7	CO2	L2
---	-----	----

(OR)

4. a) Station A needs to send a message of 15 packets to Station B using a sliding window protocol with a window size of 5. All packets are immediately available for transmission. Suppose every 4th packet that Station A transmits is lost (but no ACKs from Station B are lost). Determine how many total packets will Station A need to transmit to successfully send the message to Station B if the Selective Repeat control strategy is used?
- b) Describe the working principles of error detection and correction techniques such as CRC and Hamming code with examples.

7	CO2	L3
---	-----	----

7	CO2	L2
---	-----	----

UNIT-III

5. a) Explain IPv4 header format in detail.
- b) An organization is granted a block 211.17.180.0/24. The network administrator wants to create 32 subnets. Find the first and last address in the first subnet.

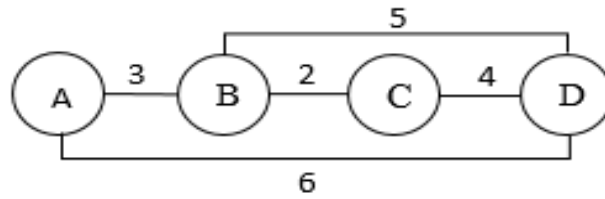
7	CO3	L3
---	-----	----

7	CO3	L3
---	-----	----

(OR)

6. a) Consider the router nodes given in figure below and assume that all nodes are initialized first.

7 CO3 L3



Assume that suddenly the link between nodes B and C fails. Apply Distance vector routing and show how this link failure is propagated and determine the distance vector for each node after stabilization.

- b) Explain IPv6 header format in detail and compare IPv4 and IPv6.

7 CO3 L3

UNIT-IV

7. a) Consider TCP's congestion control mechanism on a line with a 10 msec RTT and no congestion. The receiver window is 24 KB and the maximum segment size is 2 KB. Compute the slow start threshold.

7 CO4 L3

- b) Explain in detail the TCP connection establishment and release process with a diagram of the three-way handshake.

7 CO4 L2

(OR)

8. a) Explain in detail the UDP Segment Header process with a diagram.

7 CO4 L2

- b) Discuss flow control mechanisms used at the transport layer with suitable examples.

7 CO4 L1

UNIT-V

9. a) Explain the Client-Server model and Application Layer paradigms. How do these paradigms support communication in distributed systems?

7 CO5 L2

- b) Describe the working principles of HTTP. How do this protocol interact to deliver web resources?

7 CO5 L2

(OR)

10. a) Discuss the functions and working mechanisms of TELNET and FTP protocols. Compare their applications and limitations.

7 CO5 L2

- b) Susan has previously visited the eBay website and now visits Amazon for the first time. Upon receiving Susan's request, the Amazon server generates a unique identification number '1678' and sends it back in the HTTP response. Her browser stores this identification number in a cookie file containing entries from previously visited sites e.g., eBay cookies have '8734' unique identification number. For all subsequent requests to Amazon, Susan's browser includes this cookie in the HTTP headers, allowing Amazon to track her session to personalize her experience. If Susan returns a week later, the cookie will still be sent with each request. Consider the scenario and describe in what ways does Amazon use the stored cookie to enhance Susan's experience?

7 CO5 L4

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

- | | | Marks | CO | BTL |
|-------|--|-------|----|-----|
| 1. a) | Draw and explain the torque-slip characteristics of an induction motor. | 7 | 1 | K2 |
| b) | In a 6 pole, 3-phase 50 Hz induction motor with star connected rotor, the rotor resistance per phase is 0.3 ohm, the reactance at standstill is 1.5 ohm per phase and an emf between the slip rings on open circuit is 175V. Calculate: a) slip at a speed of 960 rpm., b) rotor emf per phase, rotor frequency at a speed of 950 rpm. | 7 | 1 | K3 |

(OR)

- | | | | | |
|-------|---|---|---|----|
| 2. a) | Explain the equivalent circuit of a 3-phase induction motor with diagram? | 7 | 1 | K2 |
| b) | Derive an expression for torque for a 3-phase Induction motor? | 7 | 1 | K2 |

UNIT-II

- | | | | | |
|-------|--|---|---|----|
| 3. a) | Explain the speed control of Induction Motor with V/f control method? | 7 | 2 | K2 |
| b) | Explain the blocked rotor test of a 3-phase induction motor to find its equivalent circuit parameters. | 7 | 2 | K2 |

(OR)

- | | | | | |
|-------|--|---|---|----|
| 4. a) | Draw the circle diagram of an induction motor and explain how to determine performance parameters. | 7 | 2 | K2 |
| b) | Explain the starting of Induction Motor using Auto transformer starter? | 7 | 2 | K2 |

UNIT-III

- | | | | | |
|-------|---|---|---|----|
| 5. a) | Draw the phasor diagram of alternator on leading, lagging power factor load. | 7 | 3 | K2 |
| b) | A 3-phase, 16-pole alternator has the following data:
Number of slots=192; conductors/slot=8; coil span=160 electrical degrees; speed of the alternator=375 rpm; flux/pole=55 m.Wb; Calculate the phase and line voltages. | 7 | 3 | K3 |

(OR)

- | | | | | |
|-------|--|---|---|----|
| 6. a) | Derive the EMF equation of Alternator from fundamentals. | 7 | 3 | K2 |
| b) | Give the constructional details of both salient pole and cylindrical rotor synchronous machines. | 7 | 3 | K2 |

UNIT-IV

- | | | | | |
|-------|---|---|---|----|
| 7. a) | Explain the Synchronous Impedance method of determining the voltage regulation of alternator? | 7 | 4 | K2 |
| b) | Calculate the maximum load of a 5000 kVA, 1 phase alternator having an equivalent reactance of 5 ohm when connected to 6600 V bus bars, if its excitation is such that the electromotive force on open circuit would be 6000V. Find the armature current and power factor at this load. | 7 | 4 | K3 |

(OR)

- | | | | | |
|-------|--|---|---|----|
| 8. a) | Describe procedure of short circuit test on alternator. | 7 | 4 | K2 |
| b) | A three phase, 50 Hz, two pole star connected turbo alternator has 54 slots with 4 conductors per slot. The pitch of the coils is 2slots less than pole pitch. If the machine gives 2200 V between the lines on the open circuit with sinusoidal flux distribution, find the useful flux per pole. | 7 | 4 | K3 |

UNIT-V

- | | | | | |
|-------|---|---|---|----|
| 9. a) | Draw and explain the 'V-curves' and 'inverted V-curves' of synchronous motor? | 7 | 5 | K2 |
| b) | A 75kW, 400V, 4-pole, 3-phase, star connected synchronous motor has a resistance and reactance per phase of 0.04ohm and 0.4ohm respectively. Compute for full load 0.8pf lead the open circuit emf per phase and gross mechanical power developed. Assume an efficiency of 92.5%. | 7 | 5 | K3 |

(OR)

- | | | | | |
|--------|--|---|---|----|
| 10. a) | Write short notes on methods of starting a synchronous motor. | 7 | 5 | K2 |
| b) | A 2000V, 3 Phase star-connected synchronous motor has an effective resistance and synchronous reactance of 0.2 ohm and 2.2 ohm per phase respectively. The input is 800 kW at normal voltage and the induced line electromotive force is 2500V. Calculate the line current and power factor. | 7 | 5 | K3 |

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Elaborate on the significance of E-field and H-field radiation patterns.	7M	CO1	BL4
	b)	Derive the radiation resistance half-wave dipole.	7M	CO1	BL3
		(OR)			
2.	a)	Prove that an alternating current element radiates magnetic field only on ϕ -plane?	7M	CO1	BL3
	b)	Discuss about directivity and effective area of an antenna.	7M	CO1	BL3
		<u>UNIT-II</u>			
3.	a)	Deduce the equations for main lobe and side lobe of an N-element Broadside linear array.	7M	CO2	BL3
	b)	Write short notes on array factor, beamwidth, side lobes, and array directivity in the context of End-fire linear arrays.	7M	CO2	BL2
		(OR)			
4.	a)	Describe the radiation mechanism of a two-element Broadside array and discuss the effect of phase difference and spacing between the elements.	7M	CO2	BL2
	b)	Illustrate the principle of pattern multiplication with an example.	7M	CO2	BL3
		<u>UNIT-III</u>			
5.	a)	Design a helical antenna and explain the working at axial mode?	7M	CO3	BL3
	b)	Compare reflector antennas and lens antennas in terms of focusing principle, design, and efficiency.	7M	CO3	BL3
		(OR)			
6.	a)	Discuss the construction, working principle, and characteristics of long-wire antennas.	7M	CO3	BL3
	b)	Examine the Cassegrain feed system with a neat diagram and evaluate its advantages in large antenna installations.	7M	CO3	BL3
		<u>UNIT-IV</u>			
7.	a)	Outline the concept of optimum horn design and identify the parameters considered for achieving maximum efficiency and minimum reflection.	7M	CO4	BL3
	b)	Demonstrate the techniques for measuring antenna directivity and show how it relates to the radiation pattern.	7M	CO4	BL4
		(OR)			
8.	a)	Examine the geometry of a rectangular microstrip antenna with neat diagrams and identify its key parameters.	7M	CO4	BL4
	b)	Show the techniques for measuring antenna input impedance and explain why impedance matching is critical for antenna performance.	7M	CO4	BL3
		<u>UNIT-V</u>			
9.	a)	Explain ground wave propagation and its limitations.	7M	CO5	BL3
	b)	Differentiate between the radio horizon and the optical horizon, defining each and explaining their differences.	7M	CO5	BL3
		(OR)			
10.	a)	Evaluate the concept of effective Earth radius and derive the relationship between actual and effective path curvature.	7M	CO5	BL3
	b)	Explain sky wave propagation and its limitations.	7M	CO5	BL2

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

			Marks	CO	BT
UNIT-I					
1.	a)	Explain the functions of various layers in ISO-OSI reference model	7	CO1	L2
	b)	Explain in detail about LAN & WAN. What are the advantages and disadvantages?	7	CO1	L2
(OR)					
2.	a)	Define Encapsulation and Peer to Peer communication in the layered architecture.	7	CO1	L2
	b)	Compare and contrast synchronous time division multiplexing and statistical time division multiplexing.	7	CO1	L2
UNIT-II					
3.	a)	Explain ALOHA and types of ALOHA in detail.	7	CO2	L2
	b)	Differentiate between error detecting codes and error correcting codes with suitable examples.	7	CO2	L2
(OR)					
4.	a)	Compare Go-Back-N and Selective Repeat protocols in sliding window mechanism.	7	CO2	L2
	b)	Explain the concept of Carrier Sense Multiple Access (CSMA) protocols and describe how the different types of CSMA work in managing channel access.	7	CO2	L2
UNIT-III					
5.	a)	Consider a network with nodes A, B, C, D, and E connected as follows: A connects to B and C B connects to D C connects to D and E D connects to E If node A wants to send a packet to node E using flooding, list all possible paths the packet will take and indicate if any duplicates occur.	7	CO3	L3
	b)	State and explain the Optimality Principle in routing algorithms with an example.	7	CO3	L2
(OR)					
6.	a)	A university network has 3 departments (D1, D2, D3). Each department has 2 routers: D1: R1, R2 D2: R3, R4 D3: R5, R6 Assume inter-department links have cost 10 and intra-department links have cost 2. Draw a hierarchical routing diagram and calculate the shortest path from R2 (D1) to R5 (D3).	7	CO3	L3
	b)	Explain the design issues of the network layer. Discuss the services it provides to the transport layer, including connection-oriented and connectionless services.	7	CO3	L2
UNIT-IV					
7.	a)	Explain in brief about TCP connection establishment and Release.	7	CO4	L2
	b)	Explain UDP services and its applications.	7	CO4	L2
(OR)					
8.	a)	Describe in detail about TCP segment header and connection Establishment.	7	CO4	L2
	b)	Explain the services provided by the Transport Layer to the upper layers with suitable examples.	7	CO4	L2
UNIT-V					
9.	a)	What is HTTP? Describe in brief about HTTP request methods.	7	CO5	L2
	b)	Write short notes on the following Message Access Agent: POP and IMAP	7	CO5	L2
(OR)					
10.	a)	When user clicks a hyperlink, what are the steps that occur between the user's click and the page being displayed?	7	CO5	L2
	b)	Discuss about DNS name servers.	7	CO5	L2

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		Marks	CO	BTL
UNIT-I				
1.	a) What is meant by 'limit state'? Discuss the different 'limit state' to be considered in reinforced concrete design.	7	1	1
	b) Explain characteristic strength of concrete and steel.	7	1	1
(OR)				
2.	a) Explain the various design methods used in RC structures.	7	1	1
	b) Differentiate between working stress method and Limit state method	7	1	2
UNIT-II				
3.	Design the reinforcement for a T-beam and apply design checks for the following data: Effective span = 8 m (Ends simply supported), Spacing of beams = 3.3 m centre to centre., Thickness of flange = 130 mm., Width of web = 300 mm., Total depth of T-beam = 450 mm., Live load on the floor = 10 kN/m ² . , Floor finish load = 0.75 kN/m ² . , The beam also supports a partition wall which transmits a load of 12 kN/m run. Use M20 concrete and Fe 415 steel.	14	2	4
(OR)				
4.	Determine the reinforcement required for a rectangular beam section with the following data: Width of section = 300 mm., Depth of section = 500 mm., Factored bending moment = 65 kN-m., Factored torsional moment = 40 kN-m., Factored shear force = 70 kN. Use M25 concrete and Fe 500 steel.	14	2	4
UNIT-III				
5.	Design a reinforced concrete slab for a room having inside dimensions 3 m x 7 m. The thickness of supporting wall is 300 mm. The slab carries 75 mm thick lime concrete at its top, the unit weight is 20 kN/m ² . Assume the slab to be simply supported at the ends. Use M20 concrete and Fe 415 steel.	14	3	4
(OR)				
6.	Design a two way slab for a room size 4m x 5m with discontinuous and simply supported edges on all four sides with corners prevented from lifting to support a live load 4 kN/m ² . Adopt M 20 grade concrete and Fe 415 HYSD bars.	14	3	4
UNIT-IV				
7.	a) Why does the code specify limits to the minimum and maximum reinforcement in column.	4	4	2
	b) Design a short rectangular column in moderate Environment subjected to a factored axial load of 1400kN and factored bending moment of 380kNm. Adopt M25 grade of concrete and Fe415 steel.(Under uniaxial eccentricity)	10	4	4
(OR)				
8.	a) According to IS code all the RCC columns shall be designed for minimum eccentricity. Justify the reasons of this statement.	4	4	2
	b) Design the reinforcements in a short column 400 x 600mm subjected to an ultimate load of 1500kNm together with ultimate moments of 120kNm about the major and minor axes. Adopt M-20 concrete and Fe 415 steel.	10	4	4
UNIT-V				
9.	Design a square footing for a rectangular column 300 x 500 mm reinforced with 6-25mm dia bars and carrying a service load of 1250 kN. Assume soil with an allowable pressure of 200kN/m ² at a depth of 1.25m below ground. Assume Fe415 steel and M20 grade of concrete.	14	5	4
(OR)				
10.	Design an isolated rectangular footing for a column of size 350mm x 500mm carrying an axial service load of 1200kN. The safe bearing capacity of the soil is 140 kN/m ² . Use M20 concrete and Fe-415 steel. Draw reinforcement detailing. Unit weight of soil is 18 kN/m ³ .	14	5	4

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Explain Asymptotic Notations with examples.	7	1	1
	b)	What are the criteria an algorithm must satisfy? Also discuss various areas need to study and understand for developing an algorithm.	7	1	2
		(OR)			
2.	a)	Differentiate between Big-O, Omega (Ω), and Theta (Θ) notations with suitable examples.	7	1	2
	b)	Define an algorithm. Write an algorithm to check whether a given number is prime or not.	7	1	1
		<u>UNIT-II</u>			
3.	a)	Explain the binary search algorithm and trace the steps to search element 25 in the array [10, 15, 20, 25, 30, 35, 40].	7	2	3
	b)	Explain the Defective Chessboard problem using Divide and Conquer method.	7	2	3
		(OR)			
4.	a)	Explain Merge Sort algorithm and sort the following list: [42, 17, 8, 23, 56, 34].	7	2	2
	b)	Compare Quick Sort and Merge Sort on the basis of their time complexities.	7	2	3
		<u>UNIT-III</u>			
5.	a)	Solve a Knapsack problem using Greedy method for $W=50$, items = {(60,10), (100,20), (120,30)}.	7	3	3
	b)	Write an algorithm for Kruskal's algorithm to find the Minimum Cost Spanning Tree (MST).	7	3	2
		(OR)			
6.	a)	Define minimum cost spanning trees. Give two different types of finding minimum cost spanning tree for a given graph with an example.	7	3	3
	b)	Define the Greedy method. Explain its general strategy with an example.	7	3	3
		<u>UNIT-IV</u>			
7.	a)	Briefly argue how principle of optimality holds for 0/1 knapsack problem. Generate the sets $S_i, 0 \leq i \leq 4$ where $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$ and $(p_1, p_2, p_3, p_4) = (2, 5, 8, 9)$. State the purging rule used. If the capacity is $M=25$, What is the optimal solution?	7	4	2
	b)	Write the algorithm for Floyd-Warshall's All-Pairs Shortest Path problem.	7	4	3
		(OR)			
8.	a)	Write short notes on the principle of optimality with respect to Dynamic Programming.	7	4	2
	b)	Illustrate Informal knapsack algorithm by using dynamic Programming.	7	4	3
		<u>UNIT-V</u>			
9.	a)	Define Backtracking. Explain the general method with a neat flowchart.	7	5	2
	b)	Write an algorithm for the N-Queens problem using Backtracking.	7	5	3
		(OR)			
10.	a)	For $m=30$ and weights = (10, 12, 15), draw the portion of the state space tree using the Sum of Subsets algorithm.	7	5	2
	b)	Draw the state space tree for mColoring when $n=4$ and $m=3$.	7	5	3

**MACHINE DESIGN
(MECHANICAL ENGINEERING)****Time: 3 Hours****Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

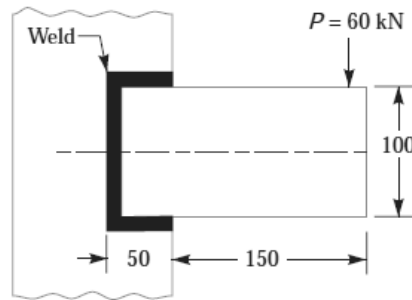
	Marks	CO	Blooms Level
1. a) Design a suitable diameter for a circular shaft required to transmit 90 kW at 180 r.p.m. The shear stress in the shaft is not to exceed 70 MPa and the maximum torque exceeds the mean by 40%. Also find the angle of twist in a length of 2 metres. Take $C = 90$ GPa.	7M	CO1	BL3
b) Compare ductile and brittle materials with examples	3M	CO1	BL2
(OR)			
2. a) A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a torsional moment 30 kN-m. Determine the diameter of the shaft using (a) Maximum principle stress theory (b) Maximum shear stress theory. Assume factor of safety of 2. Take $E = 210$ GPa and poisson's ratio = 0.25.	7M	CO1	BL3
b) Explain the sequence of steps in engineering design of a component.	3M	CO1	BL2

UNIT-II

3. a) Illustrate how the stress concentration in a component can be reduced.	4M	CO2	BL2
b) A rotating shaft of 38mm is made of forged 40C8 steel ($S_{ut} = 550$ MPa, $S_{yt} = 400$ MPa). The shaft is stepped down to 32mm, diameter and is subjected to a bending moment (maximum 150 N-m, minimum 50 N-m) at the step. Determine factor of safety for 99% reliability and machined surface finish. Fillet radius at the step = 2 mm.	6M	CO2	BL3
(OR)			
4. a) Design a muff or sleeve coupling for a shaft to transmit 35kW at 350 rpm. The safe shear stress for the steel shaft 50 N/mm ² and for the cast iron muff it is 15 N/mm ² . The allowable shear and crushing stresses for the key material are 42 N/mm ² and 120 N/mm ² respectively.	7M	CO2	BL3
b) Compare rigid and flexible couplings	3M	CO2	BL2

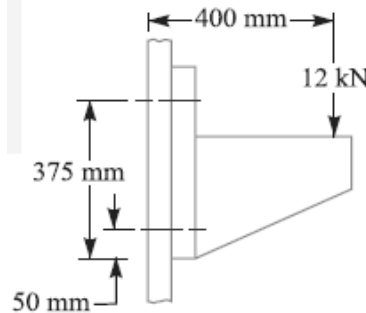
UNIT-III

5. A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P , as shown in Figure. Determine the weld size if shear stress in the seam is not to exceed 140 MPa. 10M CO3 BL3



(OR)

6. For supporting the travelling crane in a workshop, the brackets are fixed on steel columns as shown in Figure. The maximum load that comes on the bracket is 12 kN acting vertically at a distance of 400 mm from the face of the column. The vertical face of the bracket is secured to a column by four bolts, in two rows (two in each row) at a distance of 50 mm from the lower edge of the bracket. Determine the size of the bolts if the permissible value of the tensile stress for the bolt material is 84 MPa. 10M CO3 BL3



UNIT-IV

7. a) A leather belt $9 \text{ mm} \times 250 \text{ mm}$ is used to drive a cast iron pulley 900 mm in diameter at 336 r.p.m. If the arc of contact on the smaller pulley is 120° and the stress in tight side is 2 MPa, find the power capacity of the belt. The density of leather may be taken as 980 kg/m^3 , and the coefficient of friction of leather on cast iron is 0.35. 5M CO4 BL3
- b) The cylinder of a four-stroke diesel engine has the following specifications: Brake power = 3.75 kW Speed = 1000 rpm Indicated mean effective pressure = 0.35 MPa Mechanical efficiency = 80% Determine the bore and length of the cylinder liner. 5M CO4 BL3

(OR)

8. a) Explain the different types of flat belt drives? 3M CO4 BL2
- b) A four stroke internal combustion engine has the following specifications: 7M CO4 BL3
 Brake power = 7.5 kW; Speed = 1000 r.p.m.; Indicated mean effective pressure = 0.35 N/mm²; Maximum gas pressure = 3.5 N/mm²; Mechanical efficiency = 80 %. Determine: 1. The dimensions of the cylinder, if the length of stroke is 1.4 times the bore of the cylinder; 2. Wall thickness of the cylinder, if the hoop stress is 35 MPa; 3. Thickness of the cylinder head and the size of studs when the permissible stresses for the cylinder head and stud materials are 45 MPa and 65 MPa respectively.

UNIT-V

9. Design a connecting rod for an I.C. engine running at 1800 r.p.m. and developing a maximum pressure of 3.15 N/mm^2 . The diameter of the piston is 100 mm ; mass of the reciprocating parts per cylinder 2.25 kg; length of connecting rod 380 mm; stroke of piston 190 mm and compression ratio 6 : 1. Take a factor of safety of 6 for the design. Take length to diameter ratio for big end bearing as 1.3 and small end bearing as 2 and the corresponding bearing pressures as 10 N/mm^2 and 15 N/mm^2 . The density of material of the rod may be taken as 8000 kg/m^3 and the allowable stress in the bolts as 60 N/mm^2 and in cap as 80 N/mm^2 . The rod is to be of I-section for which you can choose your own proportions.

(OR)

10. Design an overhung crankshaft for a $300 \times 350 \text{ mm}$ single cylinder vertical engine using the following data: Maximum gas pressure = 2.5 MPa ; (L/r) ratio = 4.5; Weight of flywheel cum belt pulley = 10 kN; Total belt pull = 5 kN; Width of hub for flywheel cum belt pulley = 150 mm. The torque on the crankshaft is maximum when the crank turns through 35° from the top dead centre and at this position the gas pressure inside the cylinder is 1 MPa. The belts are in the horizontal direction. Assume suitable data and state the assumptions you make.

UNIT-VI

11. A pair of straight teeth spur gears is to transmit 20 kW when the pinion rotates at 300 r.p.m. The velocity ratio is 1 : 3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine : 1. module; 2. face width; and 3. pitch circle diameters of both the pinion and the gear from the stand point of strength only, taking into consideration the effect of the dynamic loading.

(OR)

12. A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 r.p.m. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear?

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

<u>UNIT-I</u>		Marks	CO	Blooms Level
1.	a) State and explain Coulomb's law. Obtain an expression in vector form.	5	CO1	Understanding
	b) Three equal point charges +Q are located at the corners of an equilateral triangle. Determine the amount of charge to be placed at the centroid to keep the all the charges in equilibrium	5	CO1	Applying
<u>(OR)</u>				
2.	a) Derive the infinite line Electric field $E = \rho L / 2\pi\epsilon\rho$ ap	5	CO1	Understanding
	b) Find the force on a charge of -100mC located at P(2,0,5) in free space due to another Charge of 300μC located at Q(1,2,3).	5	CO1	Applying
<u>UNIT-II</u>				
3.	a) Explain behaviour of conductors in an electric field	5	CO2	Remembering
	b) State and explain boundary conditions between two dielectric media	5	CO2	Understanding
<u>(OR)</u>				
4.	a) Derive the torque equation by dipole.	5	CO2	Understanding
	b) Explain the different types of polarization.	5	CO2	Remembering
<u>UNIT-III</u>				
5.	a) Prove the poisson's equation for Electrostatic field	5	CO3	Understanding
	b) Find the capacitance of a 50cm.long coaxial cable, having conductors of 4cm and 2cm diameters, separated by a medium of a relative permittivity 2.56.	5	CO3	Applying
<u>(OR)</u>				
6.	a) State and prove Continuity equation.	5	CO3	Understanding
	b) Derive an expression for capacitances of a cylindrical capacitor.	5	CO3	Understanding
<u>UNIT-IV</u>				
7.	a) Explain point and integral forms for Static fields with the help of Ampere's Circuit Law	5	CO4	Understanding
	b) A circular loop located on $x^2 + y^2 = 9$, $Z = 0$ carries a direct current of 10 A along \mathbf{a}_ϕ . Determine \vec{H} at (0, 0, 4).	5	CO4	Applying
<u>(OR)</u>				
8.	a) State and Explain about Biot-Savarts law.	5	CO4	Understanding
	b) Explain Maxwell's two equations for Magneto static Fields	5	CO4	Understanding
<u>UNIT-V</u>				
9.	a) Explain in detail about Self and mutual inductance	5	CO5	Understanding
	b) A coil of 500 turns is wound on a closed iron ring of mean radius 10 cm and cross sectionarea of 3 cm^2 . Find the self inductance of the winding if the relative permeability of iron is 800.	5	CO5	Applying
<u>(OR)</u>				
10.	a) Derive the expression for toroid inductance	5	CO5	Understanding
	b) Derive an expression for mutual inductance between a straight conductor and square loop.	5	CO5	Understanding
<u>UNIT-VI</u>				
11.	a) Derive an expression for displacement current density	5	CO6	Understanding
	b) Discuss about poynting theorem. Write the significance of it.	5	CO6	Remembering
<u>(OR)</u>				
12.	a) What is the Faraday's law of induction and derive an expression in point form.	5	CO6	Understanding
	b) Obtain the integral form of Maxwell's equation for time varying fields.	5	CO6	Understanding

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

- | | <u>UNIT-I</u> | Marks | CO | Blooms Level |
|---|----------------------|-------|---------------|--------------|
| 1. a) Write about the advantages of digital communications. | 5M | CO1 | Understanding | |
| b) Derive mean square quantization error. | 5M | CO1 | Understanding | |
| (OR) | | | | |
| 2. a) Draw and explain major drawbacks in DM system. | 5M | CO1 | Understanding | |
| b) A DM system can handle message signals of bandwidth up to 5 kHz and has a sampling rate of 50 kHz. A sinusoidal signal of 1.5 volts peak amplitude and frequency 2 kHz is applied to the system. Determine the (S/N) q for the system for the given sinusoidal signal. | 5M | CO1 | Applying | |
| <u>UNIT-II</u> | | | | |
| 3. a) Draw and explain QPSK transmitter. | 5M | CO2 | Understanding | |
| b) Explain the process of detection of Binary ASK signals. | 5M | CO2 | Understanding | |
| (OR) | | | | |
| 4. a) Explain coherent reception of PSK signals. | 5M | CO2 | Understanding | |
| b) Define and draw the FSK waveform for the data 1 1 0 1 1 1 0 1 using bipolar RZ and NRZ signalling formats. | 5M | CO2 | Applying | |
| <u>UNIT-III</u> | | | | |
| 5. a) Calculate the Impulse response for the Matched Filter? | 5M | CO3 | Understanding | |
| b) Briefly explain integrate and dump correlation receiver. | 5M | CO3 | Applying | |
| (OR) | | | | |
| 6. a) Evaluate the transfer function for the Optimum filter. | 5M | CO3 | Applying | |
| b) Derive the probability of bit error of coherent ASK. | 5M | CO3 | Applying | |

UNIT-IV

7. a) State and explain the properties of Mutual information. 5M CO4 Remembering
- b) An analog signal band limited to 10 kHz is quantized in 8 levels of a PCM system with probabilities of $1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20$ and $1/20$ respectively. Find the entropy and the rate of information. 5M CO4 Applying

(OR)

8. a) The probabilities of the five possible outcomes of an experiment are given as $1/2, 1/4, 1/8, 1/16$ and $1/16$ respectively. Determine the entropy and information rate if there are 32 outcomes per second. 5M CO4 Applying
- b) Explain about the logarithmic measure of information. 5M CO4 Remembering

UNIT-V

9. a) Construct Huffman code and calculate efficiency for a DMS X has six symbols X_1, X_2, X_3, X_4, X_5 and X_6 with probabilities 0.20, 0.08, 0.30, 0.05, 0.25 and 0.12 respectively attached to every symbol. 5M CO5 Applying
- b) Derive the channel capacity of AWGN channel. 5M CO5 Remembering

(OR)

10. a) Draw and explain encoder of (7,4) Hamming code. 5M CO5 Applying
- b) The parity check bits of a (8,4) block code are generated by
 $c_5 = d_1 + d_2 + d_4$
 $c_6 = d_1 + d_2 + d_3$
 $c_7 = d_1 + d_3 + d_4$
 $c_8 = d_2 + d_3 + d_4$
where d_1, d_2, d_3 and d_4 are the message digits. Find the generator matrix and parity check matrix. 5M CO5 Applying

UNIT-VI

11. a) Explain encoding of convolution codes using time domain approach using suitable example. 5M CO6 Understanding
- b) Draw the encoder structure of (2,1,2) convolutional encoder with $V_1 = X_1, V_2 = X_1$ modulo- two X_2 . Draw the State diagram and Tree diagram for the input data 111. 5M CO6 Applying

(OR)

12. a) Draw the convolutional encoder structure for $k=3$, rate $1/3$ code generated by $g_1(x) = 1+x^2, g_2(x) = 1+x$ and , generate code for the input data 101. 5M CO6 Applying
- b) How to decode convolutional codes? Explain in detail. 5M CO6 Understanding

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

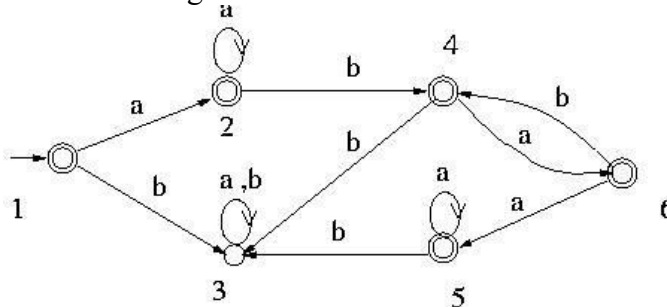
UNIT-I

1. a) Construct DFA accepting the set of all strings of 0's and 1's and not containing 101 as a substring.
- b) Construct a Moore machine to determine the residue mod 3 for each binary string treated as a binary integer.

Marks	CO	Blooms Level
6	CO1	K3
4	CO1	K3

(OR)

2. a) Minimize the following DFA



CO1

- b) Differentiate NFA and DFA

7		K4
3	CO1	K2

UNIT-II

3. a) Describe the closure properties of regular sets
- b) Show that $L = \{ww^R \mid w \in \{a, b\}^*\}$ is not regular.

4	CO2	K2
6	CO2	K3

(OR)

4. a) State Arden's theorem
- b) Construct NFA equivalent to the regular expression $10 + (0+11)0^*$

2	CO2	K1
8	CO2	K3

UNIT-III

5. a) Define regular linear grammar
- b) Construct a DFA equivalent to the grammar
 $S \rightarrow aS \mid bS \mid aA,$
 $A \rightarrow bB,$
 $B \rightarrow aC,$
 $C \rightarrow \epsilon$

2	CO3	K1
8	CO3	K3

(OR)

6. a) Generate the grammar to generate a language consisting of any number of a's and b's with at least one b.
- b) Check whether the following grammar is ambiguous?
 $S \rightarrow aB \mid bA,$
 $A \rightarrow aS \mid bAA \mid a,$
 $B \rightarrow bS \mid aBB \mid b$

4	CO3	K4
6	CO3	K3

UNIT-IV

7. Convert the following Context Free Grammar to Greibach Normal Form
 $G = (\{S, A, B\}, \{a, b\}, P, S)$ P is
 $S \rightarrow AB$
 $A \rightarrow BS \mid a$
 $B \rightarrow SA \mid b$

(OR)

8. Simplify the following grammar and convert it into CNF
 $S \rightarrow AaB \mid aaB$
 $A \rightarrow \epsilon$
 $B \rightarrow bbA \mid \epsilon$

UNIT-V

9. Convert the following Context Free Grammar to Push Down Automata
 $S \rightarrow 0S1 \mid A$
 $A \rightarrow 1A0 \mid S \mid \epsilon$

(OR)

10. Design Push Down Automata for the language $L = \{ww^R \mid w \in (0+1)^*\}$

UNIT-VI

11. Design a Turing Machine to accept the set of all palindrome over $\{0,1\}^*$. Draw the transition diagram for the same.

(OR)

12. Discuss briefly about the following
i) Types of Turing machines
ii) Chomsky hierarchy of languages

DESIGN OF CONCRETE STRUCTURES
(CIVIL ENGINEERING)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

	<u>UNIT-I</u>	Marks	CO	Blooms level
1.	a) Discuss briefly on different kinds of loads to be considered for the design of RCC structures.	5	CO1	Understand
	b) Explain basic assumptions in Limit State Design.	5	CO1	Understand
	(Or)			
2.	a) Differentiate between WSM and LSM.	5	CO1	Understand
	b) Explain briefly the assumption of the working stress method	5	CO1	Understand
	<u>UNIT-II</u>			
3.	a) Discuss the necessity of a doubly reinforced beam in RCC structures.	3	CO2	Understand
	b) A simply supported reinforced concrete beam is 250 mm wide, 400 mm effective depth, and is reinforced with 4 bars of 18 mm diameter as tensile steel. If the beam is subjected to a factored shear of 140 kN at the support, find the spacing of 2 – legged 6 mm diameter stirrups at support. Use M25 concrete and Fe250 steel.	7	CO2	Analysis
	(Or)			
4.	a) List the assumptions made in limit state of collapse.	3	CO2	Understand
	b) A doubly reinforced beam section is 250 mm wide and 450 mm deep to the centre of tensile reinforcement. It is reinforced with compression reinforcement of 300 mm ² at an effective cover of 50 mm and tension reinforcement of 1800 mm ² . M20-grade concrete and Fe500-grade steel are used. Determine the safe moment of resistance of the section.	7	CO2	Analysis
	<u>UNIT-III</u>			
5.	a) Define the anchorage bond in Concrete. write the formula to express it?	3	CO3	Understand
	b) A simply supported rectangular beam 250 mm x 400 mm effective depth carries a UDL load of 50 kN/m including self-weight over an effective span of 6 m. Design the shear reinforcement of the beam. If any additional data, assume suitably.	7	CO3	Analysis
	(Or)			
6.	a) Explain the given terms: Shear design, Anchorage design	3	CO3	Understand
	b) Design the shear reinforcement for an R.C.C. beam with dimensions of 230mm X 450mm effective depth subject to a shear force 100 kN reinforced with 4 bars of 16mm dia in tension. Use M20 concrete and Fe415 steel.	7	CO3	Design

UNIT-IV

7. a) Slabs are not designed for shear? Justify 3 CO4 Understand
b) Design an R/C slab of clear room dimension 3 m x 4 m supported on four walls 300 mm each width and carry a live load of 4 kN/m². Assume corners of the slab are held down, neatly sketch the detail of the slab reinforcement. (Concrete grade M25 and Steel grade Fe415). 7 CO4 Design

(Or)

8. a) Which is better one-way slab or two-way slab? Justify 3 CO4 Understand
b) Design an R.C slab of effective size 4 m x 10 m simply supported on four edges and carrying a live load 6 kN/m². Assume the corners are restrained at the ends. Design the slab for shear and bending (use the I.S code method). Use M25 grade concrete Fe415 steel. 7 CO4 Design

UNIT-V

9. a) Briefly explain the different types of columns. 3 CO5 Understand
b) An RC column 250 mm × 400 mm to carry an axial load of 1200 kN. The length of the column 3.5 m. Use M30 grade concrete and Fe415 grade steel. Sketch the reinforcement details. Design the reinforcement. 7 CO5 Analysis

(Or)

10. a) Explain the concept of biaxial bending in a structural member. 3 CO5 Understand
b) Design a column with effectively held and restrained against rotation at both ends subjected to an ultimate load of 800 kN and an ultimate moment of 150 kN-m about the major axis. If any additional data, assume suitably. 7 CO5 Analysis

UNIT-VI

11. a) Discuss the basic criteria for the design of a foundation. 3 CO6 Understand
b) A column of 350 mm x 600 mm carries a load of 1100kN. The soil-bearing capacity is 180kN/m². Use M25 concrete and Fe415 steel. Design a rectangular isolated footing. 7 CO6 Design

(Or)

12. a) List the differences between footing and foundation in construction? 3 CO6 Understand
b) An RC column, bearing a vertical design load of 800 kN and having a base of size 450 mm × 450 mm. The safe bearing capacity of the soil may be taken as 150 kN/m². Use M20 grade concrete and Fe415 grade steel. Sketch the reinforcement details. Design an isolated footing. 7 CO6 Design

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

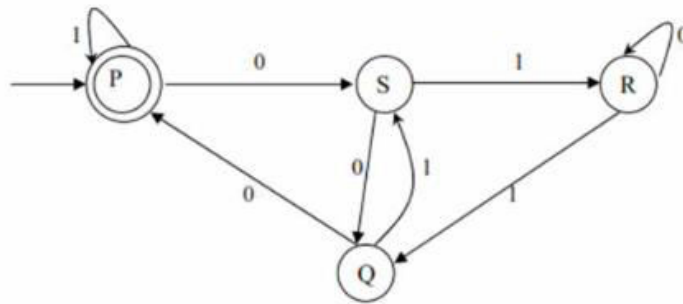
All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Construct a DFA to accept strings of a's and b's having even number of a's and b's
- b) Translate the following DFA to Regular Expression

Marks	CO	Blooms Level
5	1	3
5	1	2



(OR)

2. a) Explain in detail about phases of the compiler with neat sketch
- b) Summarize Bootstrapping

7	1	2
3	1	2

UNIT-II

3. a) Explain the error recovery in predictive parsing
- b) Discuss the production rules to eliminate the left recursion and left factoring problems.

5	2	5
5	2	6

(OR)

4. Construct predictive parser for the following grammar
 $S \rightarrow Aa|bAc|Bc|bBa$
 $A \rightarrow d$
 $B \rightarrow d$
 and parse any input string.

10	2	6
----	---	---

UNIT-III

5. What is LALR parser? Construct the set of LR(1) items for this grammar:
 $S \rightarrow CC$
 $C \rightarrow aC$
 $C \rightarrow d$

10	3	3
----	---	---

(OR)

6. Compare the difference among SLR Parser, LALR parser and Canonical LR Parser.

10	3	5
----	---	---

UNIT-IV

7. a) Outline short note on:
 i) Synthesized attributes ii) Inherited attributes
 iii) Dependency graph iv) Evaluation order
 v) Directed Acyclic Graph (DAG)
- b) What is SDD?

8	4	2
2	4	1

(OR)

- | | | | | |
|---|--|----|---|---|
| 8. | Determine the following statement into triple, indirect triple and quadruple three address code forms. $A = (B+C) * E + (B+C) * F$ | 10 | 4 | 5 |
| <u>UNIT-V</u> | | | | |
| 9. | Explain in detail about peephole optimization for the following code: $a = b - 2 * c + b - 2 * c$. | 10 | 1 | 5 |
| (OR) | | | | |
| 10. | Explain in detail about storage organization and various storage allocation strategies with neat sketch and example | 10 | 1 | 5 |
| <u>UNIT-VI</u> | | | | |
| 11. | Estimate the Target Machine code for the following C Program | 10 | 5 | 5 |
| <pre> void main() { int b; int a; b = 3; a = 12; a = (b + 2) - (a*3) / 6; } </pre> | | | | |
| (OR) | | | | |
| 12. | Explain in detail about code generation algorithm with examples | 10 | 5 | 2 |

AR18

CODE: 18EET312

SET-2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

III B.Tech I Semester Supplementary Examinations, March,2026

**ELECTRICAL MEASUREMENTS
(ELECTRICAL AND ELECTRONICS ENGINEERING)**

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Explain the terms i. Sensitivity ii. Accuracy iii. Precision 6M
b) Explain the construction and working of PMMC instruments. 6M

(OR)

2. a) Explain the different types of errors occurred in measuring instruments. 6M
b) Explain the working of deflection type M.I. Instrument 6M

UNIT-II

3. Derive and Explain the Equivalent circuit and phasor diagram of a potential transformer 12M

(OR)

4. a) Explain the procedure of measuring three phase power by using single wattmeter 6M
b) Explain how the range of wattmeter is extended. 6M

UNIT-III

5. a) What is phantom loading? Explain the testing of energy meter by phantom loading. 6M
b) What are the different errors in energy meters? How are they compensated? 6M

(OR)

6. a) Explain about operation of moving iron type of frequency meters. 6M
b) Write a short note on maximum demand meters. 6M

UNIT-IV

7. a) Deduce the condition of balance for Wheatstone bridge. 6M
b) Explain the loss of charge method of finding earth resistance. 6M

(OR)

8. a) Explain the working of Schering Bridge with the help Phasor Diagram and also derive the balance condition 6M
b) A Schering bridge has the following constants 6M
Arm AB: Capacitance of $1\mu\text{F}$ in parallel with $1.2\text{ K}\Omega$ Resistance
Arm BC: Capacitance of $1\mu\text{F}$
Arm AD: Non Reactive Resistance of $4.7\text{ K}\Omega$
Arm CD with Unknown Capacitance C_x in series with R_x .
Calculate unknown Quantities under balanced condition

UNIT-V

9. a) Explain the procedure to determine the B-H curve by step by step method 6M
b) Describe the use of ballistic galvanometer for the measurement of flux density in a ring specimen 6M

(OR)

10. a) Explain the working principle of DC potentiometer 6M
b) Explain the Working of AC Polar Potentiometer. 6M